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Memorandum

DATE: August 8, 2014

TO: Melanie Greene Armstrong, Hauge Brueck Associates
Chris Donley, CardnoENTRIX, Inc.
Andrew Strain, Heavenly Mountain Resort

FROM: Kristin Roaldson and Jill Sutherland

PROJECT: Heavenly Epic Discovery EIS/EIR/EIR

SUBJECT: BMP Monitoring Results 2006-2013

The following provides a discussion of the results from BMP Effectiveness Monitoring Program (Revised Environmental Monitoring Program, 2007) at Heavenly Mountain Resort (Heavenly), specifically for Permanent Best Management Practices (BMPs), for the period 2006 through 2013. In general, Permanent BMPs are BMPs used on a long-term basis to control erosion, reduce sediment transport, and prevent potential contaminant releases.

A description of the BMP monitoring protocol and data for the period 2006 through 2011 is found in the *Environmental Monitoring Program, Comprehensive Report, Heavenly Mountain Resort Water Years 2006 - 2011* (CardnoENTRIX, 2013). Per your request, this memo updates the evaluation with the monitoring results for 2012 and 2013 (BMP Effectiveness Monitoring annual reports, RCI, 2013, and RCI, 2014). Summaries for this period are presented below for the overall resort and, where feasible, on a watershed basis.

Resort Wide Evaluation

Permanent BMPs were routinely installed and monitored throughout the resort for both existing facilities and new projects during the monitoring period from 2006 to 2013. There were 346 separate permanent BMP evaluations completed at 117 separate sites. The number of inspections per year varied from 30 to 70 evaluations per year and averaged 43 per year. Variations are due to annual levels of activity at the Resort and the 3-year monitoring intervals. BMPs are monitored at 1, 3, 6, and 9-year intervals after they are installed, to evaluate both “implementation” and “effectiveness” over time.

Implementation

“Implementation” evaluates whether project design of BMPs are adequate for resource protection, and if BMP improvements are constructed according to the planning/management criteria. For 2006 through 2013, resort-wide Permanent BMP implementation ranged from 71 (2006) to 97 (2013) and 98 (2012) percent “fully implemented”. Evaluations averaged 47 per year with an average of only one (1) score of “not implemented” per year (Table 1). When design issues have been identified Heavenly has been responsive in correcting the situation. On the project level monitoring shows BMP implementation at Heavenly has been improving due to the following reasons.

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- Completion of BMP retrofits at most existing facilities,
- Plans and specifications for BMPs for new construction projects have been prepared with increasing levels of detail during the eight year period, and
- Improved communication of BMP objectives, as well as training and experience of Heavenly's designated BMP field crews.

Table 1. Resort Wide Permanent BMP Implementation 2006 to 2013

| Implementation Score | Average Number of Occurrences |
|----------------------|-------------------------------|
| Fully Implemented | 42 per yr. |
| Minor Departure | 3 per yr. |
| Not Implemented | 1 per yr. |
| Total | 47 per yr. |

Overall Implementation is based on scores for two components: design and construction. To improve BMP design and construction at Heavenly, a review of the not "fully implemented" occurrences was made in the 5-year Comprehensive Reports (USDA Forest Service, 2003; CardnoENTRIX, 2006, CardnoENTRIX, 2013). For the eight year period (2006-2013), 19% of the small number of deviations from "fully implemented" were related to design or planning/management criteria and 81% were related to construction activities. The results are consistent with the comprehensive report for 2006 through 2011 (CardnoENTRIX, 2013). As technology and standards evolve, these results have been used by Heavenly to identify needs and adopt improved BMP design and construction techniques. In the last four years (2010 through 2013) no evaluations scored "not implemented".

Effectiveness

Resort-wide Permanent BMP effectiveness ranged from 84 to 98 percent on an annual basis from 2006 through 2013. The number of evaluations averaged 47 per year over the eight year period with an average of one (1) score of "not effective" and four scores of "at risk" per year (Table 2). The incidences of "at risk" scores decreased over the period, primarily related to implementation of new BMP techniques resulting in more effective long term soil stabilization.

Table 2. Permanent BMP Effectiveness Scores 2006 to 2013

| Effectiveness Score | Average Number of Occurrences |
|---------------------|-------------------------------|
| Fully Effective | 43 per yr. |
| At Risk | 4 per yr. |
| Not Effective | 1 per yr. |
| Total | 47 per yr. |

Overall "effectiveness" of permanent BMPs is evaluated using six criteria: Source Control/Soil Cover, Revegetation, Slope Protection, Drainage Systems/Infiltration, Ponding, and Hazardous Materials. The results for individual criteria help Heavenly to identify which types of BMPs are the most or least effective over an extended period of time (monitoring occurs at 1, 3, 6, and 9 years after installation). Of the six categories, Source Control/Soil Cover had more occurrences of not "fully effective". However, the transition to new revegetation techniques and soil amendments during 2006 through 2007 on many projects has resulted in improving effectiveness. Of the categories, Slope Protection had the second highest incidence of scores not "fully effective". This was primarily related to slope protection BMPs transitioning from erosion control fabrics to soil amendments or rock slope protection during the 2006

to 2013 period. As projects are monitored at 1, 3, 6 and 9 year intervals, results show whether BMP techniques are effective over the long term. If monitoring results identify BMPs that lose effectiveness over time, Heavenly has upgraded the BMPs with newer techniques.

Evaluation By Watershed

Heavenly Mountain Resort facilities are located in six different watersheds, as identified in the Master Plan. The two watersheds with majority of permanent BMP evaluations are the Heavenly Valley Creek watershed (46% of evaluations) in California and the Edgewood Creek watershed (18% of evaluations) in Nevada. Overall, 61% of evaluations were performed in California and 39% performed in Nevada. Monitoring varies with levels of activity in the various watersheds and the monitoring intervals specified in the protocol.

Monitoring results are summarized in Tables 3 and 4 for the following watersheds: Heavenly Valley Creek (CA-1), Edgewood Creek (NV-3), and South Fork Daggett Creek (NV-2+5). The Mott Canyon Creek (NV-1) and Tributary to Daggett Creek (NV-4) watersheds are not included since less than ten BMP evaluations were conducted within these watersheds, providing a limited data set for the 8-year period.

Implementation

Consistent with the overall “implementation” results for the resort (Table 1) and the 2011 comprehensive report (CardnoENTRIX 2013), departures from “fully implemented” on a watershed basis were infrequent (Table 3), and were more often construction than design concerns. If field monitoring identified design or construction concerns, Heavenly has been responsive in making corrections.

Table 3. Permanent BMP Implementation Results 2006 to 2013 For Watersheds

| Average Number of Occurrences By Watershed | Heavenly Valley Creek Watershed (CA-1) | Edgewood Creek Watershed (NV-3) | South Fork of Daggett Creek Watershed (NV-2&5) |
|--|--|---------------------------------|--|
| Fully Implemented | 19 per yr. | 7 per yr. | 4 per yr. |
| Minor Departure | 2 per yr. | 0.88 per yr. | 1.5 per yr. |
| Not Implemented | 0.6 per yr. | 0.13 per yr. | 0.13 per yr. |
| Total | 21 per yr. | 8 per yr. | 6 per yr. |

Effectiveness

“Effectiveness” monitoring result by watershed shown in Table 4, show similar results to the overall resort evaluation (Table 2) and the majority of Permanent BMPs rated “fully effective”. Of BMPs found not fully effective, the Source Control/Soil Cover and Slope Stabilization criteria were again the most frequent in CA-1 and HV-3 watersheds, while Revegetation success criteria was more of a concern the NV 2&5 watershed.

Table 4. Permanent BMP Effectiveness Results 2006 to 2013 For Watersheds

| Average Number of Occurrences By Watershed | Heavenly Valley Creek Watershed (CA-1) | Edgewood Creek Watershed (NV-3) | South Fork of Daggett Creek Watershed (NV-2&5) |
|--|--|---------------------------------|--|
| Fully Effective | 19 per yr. | 7 per yr. | 5 per yr. |
| At Risk | 2 per yr. | 0.50 per yr. | 1.0 per yr. |
| Not Effective | 0.5 per yr. | 0.25 per yr.) | 0.5 per yr. |
| Total | 21 per yr. | 8 per yr. | 6 per yr. |